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V. СОВРЕМЕННЫЕ ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ И ИХ ПРИМЕНЕНИЕ

I.A. Alekseev, A.G. Kovaleva
Ural Federal University named after the first President of Russia B.N. Yeltsin
Yekaterinburg, Russia

MACHINE LEARNING IN MODERN MEDICINE: GENERAL OVERVIEW

Abstract: Big data is a term that refers to the study and application of data sets that are enormously complex, thus difficult for traditional data-processing application software to adequately deal with. Medical professionals traditionally struggle with properly collecting, computing and analyzing the data gained during their professional careers. Machine learning algorithms provide a way to alleviate the difficulty, allowing the artificial intelligence to perform the majority of the computational work. Machine learning is a field of artificial intelligence that uses statistical techniques to give computer systems the ability to learn from data, without being explicitly programmed to. Machine learning is a way to use the processing power of modern computers to work with the provided medical data, discovering new ways and methods to use the data to improve the field. The purpose of this paper is to study the current state of the technology and the variety of ways it could be employed in the field.

Keywords: artificial intelligence, machine learning, computer-aided, imaging, precision medicine, deep learning.

И.А. Алексеев, А.Г. Ковалева
Уральский федеральный университет имени первого Президента России Б.Н. Ельцина
Екатеринбург, Россия

МАШИННОЕ ОБУЧЕНИЕ В СОВРЕМЕННОЙ МЕДИЦИНЕ: ОБЩИЙ ОБЗОР

Аннотация: Под термином «большие данные» понимаются различные инструменты, подходы и методы обработки как структурированных, так и неструктурированных данных, которые не поддаются обработке классическими способами по причине больших объемов, для того, чтобы их использовать для конкретных задач и целей. Профессионалы медицинских направлений часто сталкиваются с проблемой обработки полученных данных, не в малой части из-за их количества и отсутствия однозначной структуры. Алгоритмы машинного обучения предоставляют способ облегчить эту часть работу, позволяя искусственному интеллекту взять на себя работу по обработке данных. Машинное обучение – это класс методов искусственного интеллекта, характерной чертой которых является не прямое решение задачи, а обучение в процессе применения решений множества сходных задач. Машинное обучение – это эффективный способ использовать вычислительную силу современных компьютеров для работы с данными, не только для проведения анализа, но и для поиска новых способов использовать эти данные для улучшения технологий в поле. Целью этого исследования является изучение текущего положения технологии и различных путей использования машинного обучения в медицине.

Ключевые слова: искусственный интеллект, машинное обучение, автоматизация, обработка изображений, прецизионная медицина, глубокое обучение.

The concept of big data commonly characterized by volume, variety, velocity, and veracity goes far beyond the data type and includes the

aspects of data analysis, such as hypothesis-generating, rather than hypothesis-testing. Big data focuses on temporal stability of the association, rather than on causal relationship and underlying probability distribution assumptions are frequently not required. Medical big data as material to be analyzed has various features that are not only distinct from big data of other disciplines, but also distinct from traditional clinical epidemiology. Big data technology has many areas of application in healthcare, such as predictive modeling and clinical decision support, disease or safety surveillance, public health, and research [1].

Modern researchers [2] believe that machine learning is significantly beneficial to the field of radiology. The researchers list a number of improvements and benefits it will bring to the field, improving already existing practices and creating new ones. However, it is also mentioned that deep learning comes with a number of problematic aspects, especially legal and ethical issues, which can only be resolved through discussion among radiologists, scientists, and law and ethic experts altogether.

On the other hand, machine learning is considered to be a great benefit to exploitation of patterns in imaging data and patient records for more accurate and precise quantification, diagnosis and prognosis, as well as many other improvements [3]. The experts cover the challenges ahead of machine learning, mentioning unstructured data as one of the hurdles to overcome. However, the experts do not believe there are ethical issues.

One more important issue of machine learning in medicine is artificial intelligence (AI) in cardiology. It is mentioned in various studies [5] that machine learning can greatly alleviate the number of challenges modern cardiology is facing. Despite some potential pitfalls, it is becoming evident that the best way to make decisions on the basis of data is through the application of techniques drawn from AI. Cardiologists will thus need to incorporate AI and machine learning into the clinic. Indeed, as the amount of available patient level data continues to increase and we continue to incorporate new streams of complex biomedical data into the clinic, it is likely that AI will become essential to the practice of clinical medicine. This will probably happen sooner rather than later, as exemplified by the rapid adoption of automated algorithms for computer vision in radiology and pathology [3, 4, 5]. Various experts claim that the ethical issues of AI are not significant and are not to be afraid of.

Machine learning approach in drug discovery is believed to be challenging [6]. The field of directed drug development and molecular

therapy is set to grow exponentially, largely because of big data capture and analysis, deep learning and AI.

The opinions on best machine learning approach vary largely from one medicine field to another; however, many authors agree that deep learning shows great promise due to computational power of today [2, 3, 5]. Benefits and applications of supervised learning, unsupervised learning and reinforcement learning are likewise important to consider [5].

The current state of machine learning in medicine is being collectively described as «in its infancy» by the researchers [2, 3, 6]. Indeed, the work on implementing different ways of machine learning in fields of medicine has just begun. The experts estimate from ten to twenty years before the technology will make significant impact in the field, but all the researchers agree that machine learning is the future.

The amount of benefits machine learning algorithms provide to different fields of medicine cannot be downplayed. All of the reviewed fields demonstrate great benefits after involving machine learning into their work process. The ethical and legal issues exist but can and will be resolved in the nearby future.

Different approaches to machine learning provide different benefits, some not as great as others. It varies largely by the field, by the task, amount of data, and many other factors. One approach with significant amount of mention is Deep Learning. Most experts agree with significance of Deep Learning and the potential it has [2, 3, 4, 5, 6].

The current state of machine learning in medicine can be described as its birth. Despite that, it has already shown great benefits and has opened up new, previously thought of as impossible, ways to improve the fields. The majority of experts agree that machine learning is the future of medicine [2, 3, 4, 5, 6].

In conclusion, it is very clear that machine learning has great future in various fields of medicine. Its applications are vast despite it being a new technology. It provides enormous benefits to many fields, and simple but effective benefits to the others. In several fields, machine learning has created new practices previously unheard of. Despite the difficulties ahead of the practice, it is believed that machine learning is the future.

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